IV. ULUSLARARASI TAŞ KONGRESİ

IV. INTERNATIONAL STONE CONGRESS

20-25
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2017

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Thematic Opening

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Invited Speaker

Portuguese Dimension Stones: Sector Characterization and International Market Strategies

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ABSTRACT

Despite its small size, about 98,000 km^2, Portugal presents a huge geological variety that, in what concerns the exploitation of ornamental rocks, results in the production of a great variety of rocks. Among the most internationally known are undoubtedly the high quality marbles produced in the South of the Country, Estremoz Marbles. However, in the last decades the production of ornamental Jurassic limestones, located in the Center of Portugal, has undergone a significant increase both in the variety of rocks produced and volume of production. To these materials are joined the granites, exploited a little throughout the Country, the shales (mainly in the North) and the Cretaceous limestones explored near Lisbon: the stone used in the reconstruction of the Portuguese Capital after the great earthquake of 1 of November 1755 (several varieties of "Lioz" limestone). Quartzite, jasper and volcanic rocks (in the mainland, but mainly in the Atlantic archipelagos of the Azores and Madeira) are exploited without quantitative expression.

In recent years the Worldwide growth of the sector, both as a result of the emergence of new producer countries and the generalized increase production of traditional ones, principally due to the optimization of the exploitation and processing processes, has led to extremely aggressive competition in which the material quality is not a sufficient condition for its assertion in this global market. In an attempt to consolidate the Portuguese offer of ornamental stones and to give credibility to the industry by observing strict rules of quality control, respect for the environment, social protection and contribution to the country's economic development, the Stone.PT brand was created. Is attributed to companies that meet the requirements listed in a detailed and demanding specifications. This brand allows the ensemble presentation, as a strategy of collective efficiency, of the stone Portuguese products produced in the biggest worldwide specialty fairs.

***Keywords**: Stone.PT; Portugal, Dimension Stones.*

1. INTRODUCTION

As in all Mediterranean Civilizations, also in Portugal there is an ancestral use of stone in buildings, monuments and works of art. Reporting to the Alentejo (South Central Portugal), the earliest evidence of human presence in the region dates back to the Middle Paleolithic period and, curiously, associated with marble territories. Indeed, it is in the range of metamorphosed crystalline limestones of the Montemuro mountain range, near the village of Escoural, that the 47,000 years old B.C. first fossil records of human culture are found, these traces are associated to a temporary shelter of Neanderthals hunters, now known as Escoural Cave.

This grotto was later transformed into a "Paleolithic sanctuary", as evidenced by the engravings and cave paintings that decorate it, being therefore the link of an ancient relationship of Man with the geological landscape long before the search for the fertile land proper to pastoralism and agriculture, sedentary activities based on which the "Neolithic revolution" will emerge.

The progressive occupation of the Alentejo territory by the first agro-pastoral communities, coming from the coastal and estuarine zones, seems to have been determined by the choice of well-defined places in the landscape from a geomorphological point of view. This choice, whether for ancestral connection to the worship of the ancestors or for reasons of defense, security and territorial control, the right is privileged, first and foremost, the great rocky outcrops. In them the root of megalithism was structured, a complex phenomenon where the use of "big stones" in the construction of funerary structures (table stone or dolmen), megalithic enclosures and solitary menhirs is still one of the most impressive cultural identities in the agrarian Alentejo's landscape.

The monumentalization of this landscape through "megaliths" reveals, in its gigantism, the socio-cultural complexity of the community that erected them. However, the idea of the "immortalization" of the memory of its builders has been added to this planned and conscious community effort, since the decoration of some menhirs with symbols of power (of which the staff is the most characteristic) well reveal this intentionality.

Later, concerns about defense and strategic occupation of the summits became nuclear to settlement networks. The walled waists constructed in stone on geological accidents of ample visual domain, began to define the warlike societies of the proto-historical era.

This was the landscape that the peoples of the East encountered in the Alentejo territory. First the Phoenicians, then the Punic and the Túrdulos, finally the Romans. Romanization was, moreover, an element of capital importance to the genesis of the organization of the territory as we know it today. From it prevailed the ties of the city over the ager, that is, of the city on the field. The city gained a political-administrative, regulatory and controlling dimension of the surrounding territory, opening the way to municipalization. It is not surprising, therefore, that in the hierarchy of the cities, as was the case of Ebora, Pax Julia, and of the provincial capital of Lusitania, Augusta Emerita, were to be found in the stone the glory of Rome in public buildings of never seen before. Temples, forums, aqueducts, arches of triumph, amphitheaters and theaters were built as a maximum expression of urbanity. In this context, the marble quarries located in the present axis Sousel, Estremoz, Vila Viçosa, Borba and Alandroal, even for their centrality in the provincial context of Lusitania, were explored throughout the empire to serve the purposes of the power of Rome. It is the marble, vein white, that decorates the facades of the Roman buildings of Mérida and presents itself in the tumultuous and statuary of its imposing national museum (Bilou & Branco, 2010). The oldest Roman written reference dates back to 373 B.C. (Brito da Luz, 2015).

The Roman Empire declines and the Muslim conquest of the Iberian Peninsula takes place, but in reverse to what happens in the great Muslim cities of Seville, Cordoba or Granada, in Portugal there were no major buildings until the Christian reconquest in the 12th century when the walls, castles, churches and cathedrals were built. For example, in the reign of D. Afonso III (1248-1279 A.D.) a palace of the highest architectural quality was built in Estremoz, next to that is the most elaborate and imposing tower of the country (1260 A.D.); all set in the marble of the local quarries. From here until today, the use of all kinds of stone has no more ceased and a centuries-old art of working the stone has well developed in Portugal.

This knowledge of working the hard stone was carried in ships overseas during the Portuguese Maritime Expansion (Centuries XV – XVIII). In fact according to SIPA (Information System for Architectural Heritage, http://www.monumentos.pt), there's 32747 data in 29 countries: 32707 (Portugal); 237 (Angola); 175 (Mozambique); 163 (Brazil); 105 (São Tomé e Principe); 65 (China); 52 (Cape Verde); 46 (India); 32 (East Timor); 28 (Guinea-Bissau); 5 (Morocco); 3 (Italy; Oman; Senegal, Spain and United States); 2 (Ghana; Iran; Malaysia; Paraguay); 1 (Bahrain; Benin; Ethiopia; Gambia; The Netherlands; Japan; Kenya; Myanmar; Tanzania.

The references to the use of Portuguese origin stone are many but rarely is mentioned which stone was used. For instance, in Portugal 200 national monuments are referenced where Estremoz Marble has been used in their construction (IP – IHRU, http://www.monumentos.pt). This usage constitutes an indicator of the marble's importance in the history of Portugal and certifies its value as a Global Heritage Stone Resource to be preserved. The intense long-term use is a sign of its high quality, which is the only way to justify the demand that has continued for more than 25 centuries; otherwise, demand would have ceased. Nowadays business associations and Portuguese dimension stone companies have made a huge effort towards the promotion and marketing by enhancing high levels of quality, certification, verification and management of Estremoz Marble and Portuguese Dimension Stone Sector in general (Lopes and Martins, 2015).

Also exploited since the Roman Period, the Lioz (Cenomanian age microcrystalline fossiliferous limestone) is the main stone used in the buildings and monuments of Lisbon. After the great cataclysm of 1755 A.D. (earthquake, tsunami and fire), the already known great quality and the near occurrence of these limestones were wisely used in the great reconstruction of the "Capital do Império" (Capital of the Empire). At the time, Lisbon was one of the largest European cities and great business center of the World, so the necessary and urgent reconstruction was not so difficult to start. Sebastião José de Carvalho e Melo, better known as "Marquês de Pombal", Secretary of King José I, successfully took up the challenge of rebuilding Lisbon. Also, most of the stones used in the National Palace – Convent of Mafra (1717 A.D.) belongs to the four main types of Lioz (the cream/white "Abancado", the pink/dark pink "Encarnadão", the yellow "Amarelo de Negrais" and the blueish grey "Azulino"), either cut "against" (perpendicular to the bedding plane) or "along" (parallel to the bedding plane). The orientation stone cut deeply controls texture and mechanical properties of the rocks that behaves as different ones in function of his orientation were considered. In the last two decades, the Lioz extraction was almost extinguished. However, nowadays some of the old quarries was reactivated and produces first quality blocks needed both for new works and restoration of historic buildings and monuments (Lopes, 2017).

Along the XVII and XVIII centuries, the rock was transported to some Portuguese colonies, mainly as ballast to improve the navigability of the boats, and used at the destinations as construction material for monuments, official buildings and churches. Brazil and especially Salvador, in Bahia, is the best example of that, where Lioz is

beautifully exposed in monuments and as true art in many churches where the Portuguese or Italian influences are very strong (Silva, 2017).

The Jurassic limestones exploited in the center of Portugal (geologically known as "Maciço Calcário Estremenho"; districts of Leiria and Santarém), have also been worked for centuries (for instance in the National and World Heritage Monuments of Mosteiro de Alcobaça, open in 1252 A.D. and Mosteiro da Batalha, open in 1517 A.D.). These ornamental stones have taken greater and increasing importance in recent years. Exhibits a wide variety of textures and colors and are very appreciated worldwide (among many others are the "Moca Crème", Moleanos" "Azul Valverde", "Relvinha", "Branco do Mar", "Estremadura", etc.). Regarding the economic importance in the dimension stone sector in Portugal, nowadays the region represents the most active and represents almost 50% in value in the sector.

Along the years, the economic importance of the granites have been decrease and nowadays they are mainly exploited for internal consumption. First as a raw material for construction and, when possible, as a dimension stone, the granites are exploited ever since and wherever they occur, mainly in the North of the Country, also in South Central Alentejo's region. In the South there's a distinguishing stone, the nepheline syenite from Monchique, Algarve.

2. GEOLOGY AND DIMENSION STONES IN PORTUGAL

The geological setting of Portugal can roughly be divided in three parts (Figs. 1 and 2): (1) metamorphic and deformed pre-Permian Variscan tectonostratigraphic terrains; (2) South and Occidental Meso–Cenozoic basins, and (3) Upper Cenozoic to Quaternary detrital sediments.

Figure 1 – Portugal location on Europe and geological settings, on the left. Sketches over IGM's 1:1 000 000 Geological Map of Portugal.

Map of Europe downloaded from the internet: https://upload.wikimedia.org/wikipedia/commons/3/38/Europe_topography_map_en.png.

Where to find Ornamental Rocks in Portugal? All over the Country!

The distribution of dimension stones exploited in continental Portugal are represented in the figure 2. Summary, it can be said that, with the exception of Cenozoic to actual age volcanic rocks exploited in the continent but mainly in the Portuguese archipelagos of Madeira and Azores, and the already mentioned of the Cretaceous syenite from Algarve, all others igneous dimension rocks are Variscan to late Variscan carboniferous age. Cambrian/Ordovician marbles are only exploited in Alentejo's region despite that some occurrences are now in the NE Portugal (Vimioso). Jurassic and cretaceous limestones are exploited in the South (Algarve) and in West part of the country (Extremadura). Not represented in the figure, recently, a brown gneiss is started to be exploited near Évora (Alentejo). Exploitations of Ordovician and Carboniferous slates occurs in the North and Alentejo (Fig. 2).

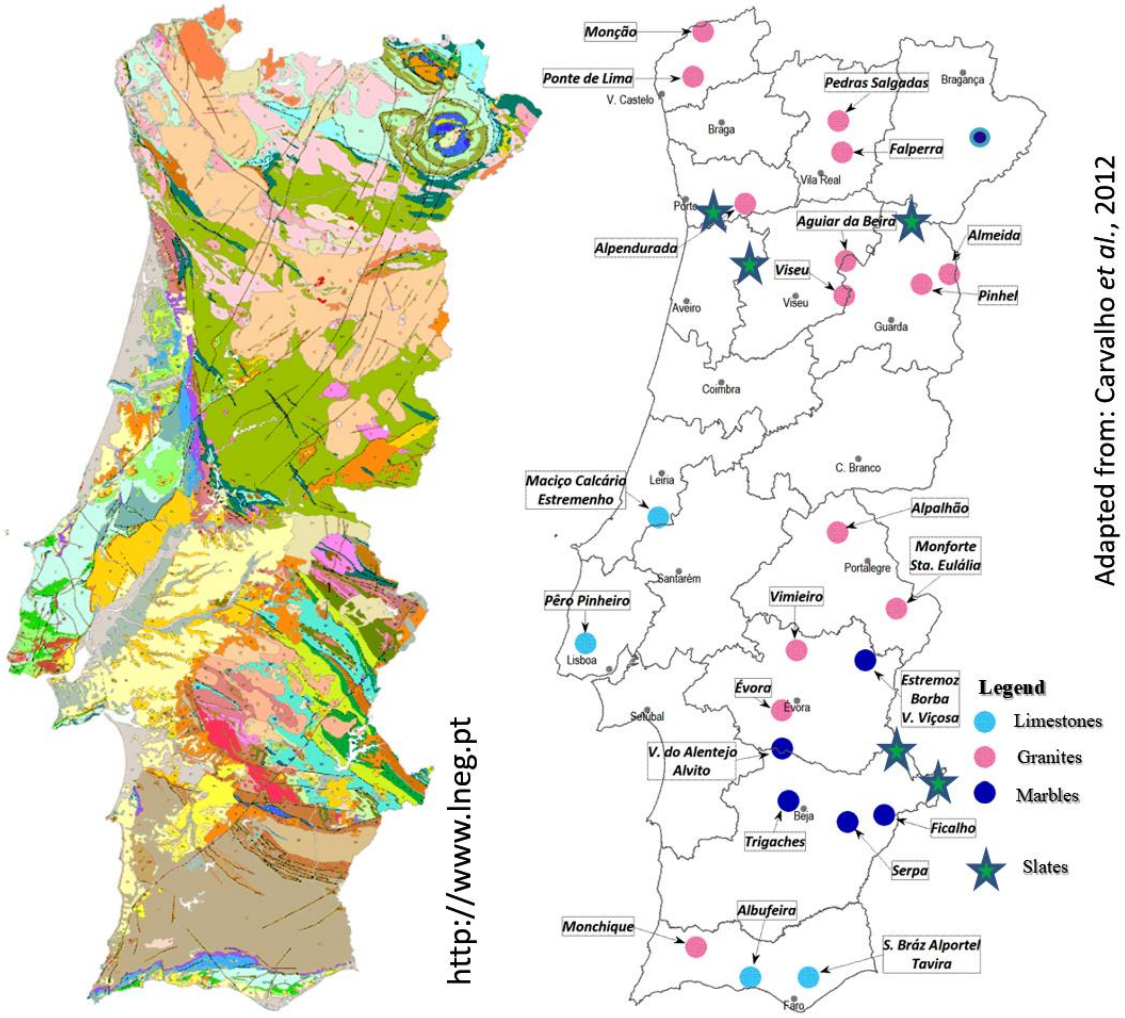

Figure 2 – Geology of Portugal and dimension stone quarries location. Adapted from the Geological Survey of Portugal (National Laboratory of Geology and Energy – LNEG, and Carvalho *et al.*, 2012).

3. SECTOR CHARACTERIZATION

The 2016 Dimension Stone World market report by Carlo Montani refer to Turkey in third place whereas Portugal fits in 9th position. Nevertheless, from 1996 to 2014 Portuguese exports increased from 1950 t to 2750 t and Turkey from 900 t to 12000 t. These numbers by itself do not count all of the history since Turkey almost all exports refers to block production and Portuguese dates refer to less than 50% in block exports (Fig. 3).

In fact, government, companies and associations carried out many efforts to add value in dimension stone production, and this battle is to be won.

		1996		2013		2014	
	Países	**1000 t**	**%**	**1000 t**	**%**	**1000 t**	**%**
1	China	7.500	16.1	39.500	30.4	42.500	31.1
2	India	3.500	7.5	19.500	15.0	22.000	14.7
3	Turquia	12th 900	1.9	12.000	9.2	3rd 11.500	8.4
4	Brasil	1.900	4.1	9.000	6.9	8.750	6.4
5	Irão	2.500	5.4	6.500	5.0	7.000	5.1
6	Itália	8.250	17.7	7.000	5.4	6.750	4.9
7	Espanha	4.250	9.1	5.000	3.8	4.850	3.6
8	Egipto	1.000	2.2	3.000	2.3	4.200	3.1
9	Portugal	6th 1.950	4.2	2.650	2.0	9th 2.750	2.0
10	EUA	1.350	2.9	2.750	2.1	2.650	1.9
11	Grécia	1.800	3.9	1.250	1.0	1.300	1.0
12	Arábia Saudita	250	0.5	1.200	0.9	1.300	1.0
13	França	1.150	2.5	1.050	0.8	1.200	0.9
14	Paquistão	200	0.4	1.000	0.8	1.000	0.7
	Sub-total	36.500	78.5	111.400	85.7	115.750	84.8
	Outros	10.000	21.5	18.600	14.3	20.750	15.2

http://www.stone-ideas.com/2015/12/06/dr-carlo-montanis-xxvi-report-marble-and-stones-in-the-world-stone-branch-in-sustained-bull-market/
https://issuu.com/marmonews/docs/2016_report

Figure 3 – Dimension Stone World market report by Carlo Montani.

Briefly, in 2008, the Portuguese Government recognized the "Cluster of Natural Stone" and Valorpedra Association was created to manage the cluster. In five years operation over than 100 projects were developed representing an investment of 54 M€.

The clustering process lead to an increase in the following parameters:

INTERNALIZATION: Exports growth; Exports of higher added value;

SUSTAINABILITY: Resource and territory qualification;

COMPETITIVENESS: Increase productivity with technological innovation.

Meanwhile, the criteria for cluster recognition were reformulate by the government and natural stone sector alone didn´t fit the criteria. So, in 2014 the "Partnership Portugal Mineral Resources" was created, in September 2016 the Portuguese Government recognized the Cluster of Mineral Resources and finally in 2017 "Valorpedra Association" became the "ACPM – Association Cluster Portugal Mineral Resources".

The figure 4 summarizes the dimension stone sector in Portugal. In 2016 it represents over than 350 M€ in exportation for 116 countries. It counts 3300 enterprises with 24000 workers, is the 8th country and the 2nd country per capita in the world international commerce, the imports are covered 823% by the exports; taking in account the small size of the country these numbers are very representative of a Sector with national importance. The ACPMR has an objective to promote knowledge and sustainable economic value for mineral resources, boosting the export capacity and the added value. Deepening

knowledge of the economic potential of resources, promoting R & D + I, improving productive investment conditions and access to markets, as well as increase skills (technical, technological, management) and stimulate inter-company and inter-institutional cooperation. Is recognized and supported by the Portuguese Government in 50% of the operational costs, so the sustainability of the association has to be achieved through contributions of the associates and fee due for management of eligible cluster submitted projects.

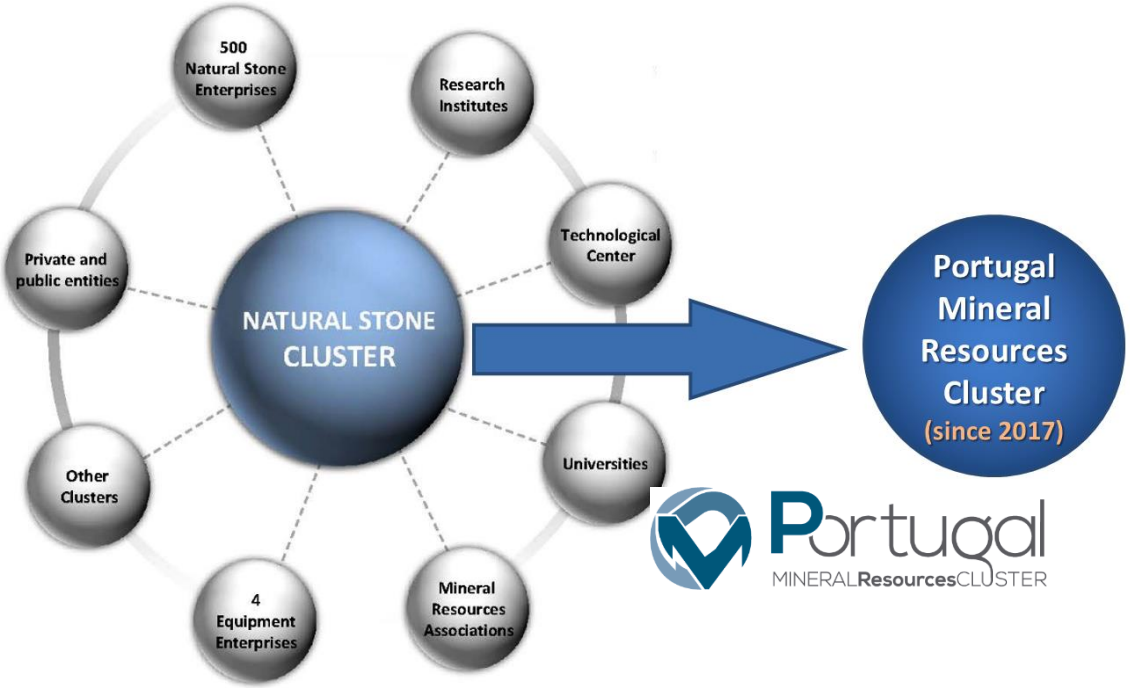

Figure 4 – Portuguese Dimension Stone Sector in 2016 before the creation of the Portugal Mineral Resources Cluster.

The Action Plan consider five axes:

1. Promotion of knowledge and innovation;
2. Economic valuation and internationalization;
3. Sustainability of mineral resources;
4. Qualification and social responsibility;
5. Cooperation and networking.

In the end of 2017 the ACPMR comprises 45 associates being 35 (78%) companies.

A report made by Novo Banco (2014), point the follow critical success factors for Portuguese Ornamental Rocks:

1. Professionalizing the management of quarries and processing companies (mainly SMEs);

2. Quality of the raw material, knowledge of its valorization, availability;
3. Internationalization and/or export of production, diversification of markets, based on the knowledge of each market, the valuation made of the national product and the final use of the stone);
4. Knowledge and mastery of marketing and international circuits (preferably, general knowledge of exports);
5. Strategies of corporate companies, so that as companies gain critical mass to operate in increasingly demanding markets;
6. Vertical integration of the units - so that it has added value (benefit) in Portugal, as well as an appreciation in the export markets (investment is required);
7. Constant introduction of new technologies in exploitation and processing raw materials (allowing innovation, new product development, cost reduction, environmental improvements).

In fact, all these criteria are being implemented in most important and greater exports companies.

The ACPMR plays a crucial role as it facilitates cross-sectoral and intrasectoral communication by enabling academics and companies, usually competing with each other in the world market, to participate as partners in projects, sharing experiences, and taking advantage of the scale effect that partnerships foster.

4. MARKETING STRATEGIES AND INTERNATIONALIZATION

Working together ACPMR, ASSIMAGRA (Marble and Granite Industrials Association), several universities, raw material and machinery producers, architects, designers and artists, have developed projects in partnership in a collective development strategy. Many projects could by access here: http://www.assimagra.pt/projetos/.

One of these successful projects is the “StonePT” – Portuguese Stone Brand, whose third edition is already approved to promote Portuguese Dimension Stone all over the World.

The main objective is to certify the Natural Stone product, so that StonePT companies can technically communicate their products, with customers and prescribers, being easily identified through its BRAND, its Identity – StonePT!

The StonePT brand is supported by a certification system, aiming at the international recognition of Portuguese natural stone construction products, not only for its physical and mechanical characteristics, but also for the Portuguese transformer knowledge. This certification system, based on technical specifications and harmonized European

standards for construction products using natural stone, aims at fulfilling a market gap regarding guarantee of origin and quality assurance associated with the processing and, not least, the suitability of using each type of stone for different applications.

StonePT® technical warranty: the certificate is voluntarily requested by companies that must demonstrates to accomplish the requirements based in the following scope:

- Guarantee of origin for Portuguese stone products
- Product Quality requirements
- Quality assurance associated to the transformation processes
- Service Quality
- Time of Delivery;
- Complaint management
- Stones adequacy of use
- Stone material traceability

Certifications:

Product certification is an instrument for producers to demonstrate, in an impartial and credible manner, the quality, reliability and performance of their products, as well as:

Certified – The StonePT mark of certification intends to fulfil an existent void in natural stone market in what concerns the extraction locations and quality assurance associated to the transformation processes and, not less important, to the adequacy of use that each type of stone has for different applications, particularly those employed in the construction sector.

The companies certified with StonePT demonstrate to accomplish the requirements based in three main pillars: origin of stone, skills to transform and control the final product, and knowledge related to the adequacy of use for each type of stone in each application (requirements for the end-user).

Verified – The environmental protection is a concern of any organization. The political discussions surrounding the subject and the consecutive increase in legislation imply a selection of suppliers that must have environmental awareness.

The StonePT Verified certification is the evidence concerning the social responsibility of the company in respect to general environmental concerns, from residues, water effluents to the impact of improving measurements in the surrounding environment. This environmental certification is completely addressed towards the extractive and transformation industry dealing with natural stone.

The StonePT Verified mark is granted to the companies that fulfil a system that commits with environmental requirements, properly adjusted to the activity leading to the transaction of Portuguese natural stone products showing also StonePT certification.

DOC – It is the CONTROL OF ORIGIN of Natural Stone

It is assigned through the classification defined for each type of stone (the original raw material) that will be equivalent / tracked to those established through national or international institutions at the nomenclature level, and is Granted to the quarry upon proof by the producer of the place of extraction, in particular at the level of geographical location and petrographic characterization. It has the advantage of accompanying the product, allowing manufacturing companies to acquire raw block while maintaining this distinctive Brand.

All the documents and information needed for the company application are freely access in: http://stone-pt.com/en/documents/ and the reliable enterprises are listed in the directory: http://assimagra.pt/diretorio_stone/.

StonePT consists of a signature that distinguishes the Portuguese Stone from all products of the competition, using independent and credible stamps and certificates – internationally – for the recognition of Portuguese Stone as a contemporary quality product.

What does it mean to be **StonePT**? It represents national values. This is why we have captured the Portuguese soul to show what it means to be the hallmark of the Portuguese ornamental stone.

The Portuguese Stone Brand presents itself with an international communication strategy, inspired by Portugal. Allusive to the slogan "We offer the Best (from Portugal to the World)", which is a declaration of Portuguese singularity, values and Portuguese raw material. Fado, football, sea and wine, ambassadors of the Portuguese name on the planet, meet the most varied types of national ornamental stones for a true celebration of what is Portuguese (Fig. 5).

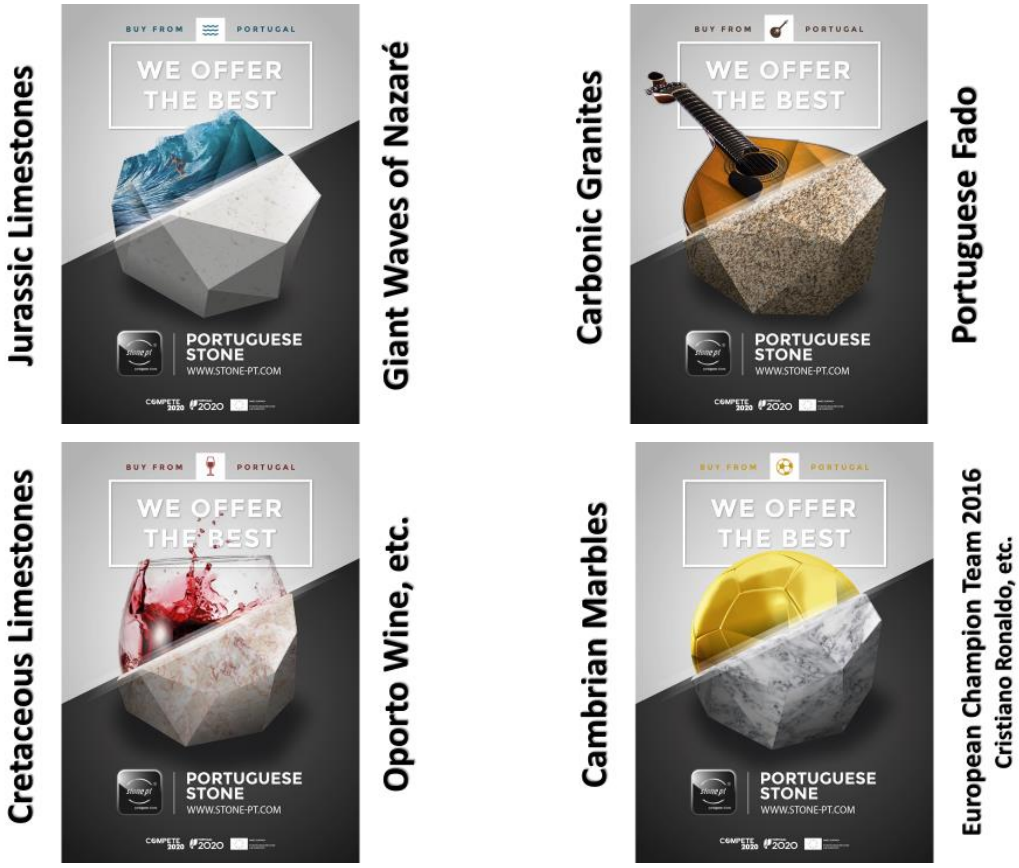

Figure 5 – Sea, fado, wine and football, ambassadors of the Portuguese name on the planet, meet the most varied types of national ornamental stones for a true celebration of what is Portuguese… http://stone-pt.com/en/communication/.

Advantages of using STONEPT brand by the companies:

1. Increases customer acceptance of products;
2. Makes the difference compared to competitors;
3. Increases competitiveness by reducing the costs of non-quality;
4. Reinforces the image of the company;
5. Facilitates access to new markets;
6. Allows to demonstrate compliance with regulatory requirements.

A new concept to promote companies that have applied for StonePT certification is now been prepared and will be presented in the biggest dimension stones worldwide fairs in 2018.

The partnership between companies and universities led to several ongoing projects. Most of them were promoted by companies that want to solve particular problems regarding stone and / or processing problems.

Innovation is a key word in the sector in Portugal and INOVSTONE 4.0 project, promoted by a machinery making company, involves 24 partners from tools and machines factories, universities and stone exploitation and processing companies, linked to new challenges in the stone industry, from applying BIM principles to processing through intelligent manufacturing technologies.

5. CONCLUSIONS

Portugal has a long tradition in exploiting and processing ornamental stones;

The Portugal Mineral Resources Cluster government recognition is a key indicator of how this sector is relevant to the Portuguese Economy;

In the last decades, the companies modernized themselves by implementing new processes and modern machines that optimize the processing of stones;

Internationalization became essential and over 90% of Portuguese production is exported. As a weak point, therefore, industry heavily depends on global political stability.

Universities and **Companies** are really focused in projects to:

a) Stone characterization, conservation and restoration;
b) Study raw materials potential problems;
c) Develop new applications;
d) Build new machines to specific problems solving;
e) Implement design and architectural inovations in brand new projects;

f) Compromised in changing the “bad” and “not environmental friendly” sector public image.

StonePT as brand for overall Portuguese Ornamental Stones was well accepted by a large number of companies and is promoted in Stone Fairs around the World.

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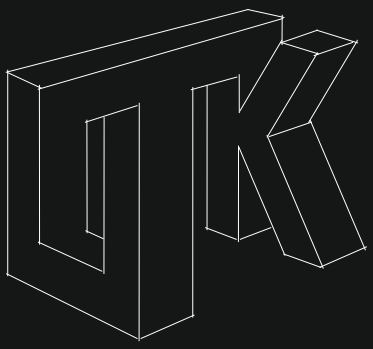

IV. ULUSLARARASI TAŞ KONGRESİ
IV. INTERNATIONAL STONE CONGRESS

TMMOB JEOLOJİ MÜHENDİSLERİ ODASI İZMİR ŞUBESİ

TMMOB MİMARLAR ODASI İZMİR ŞUBESİ

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